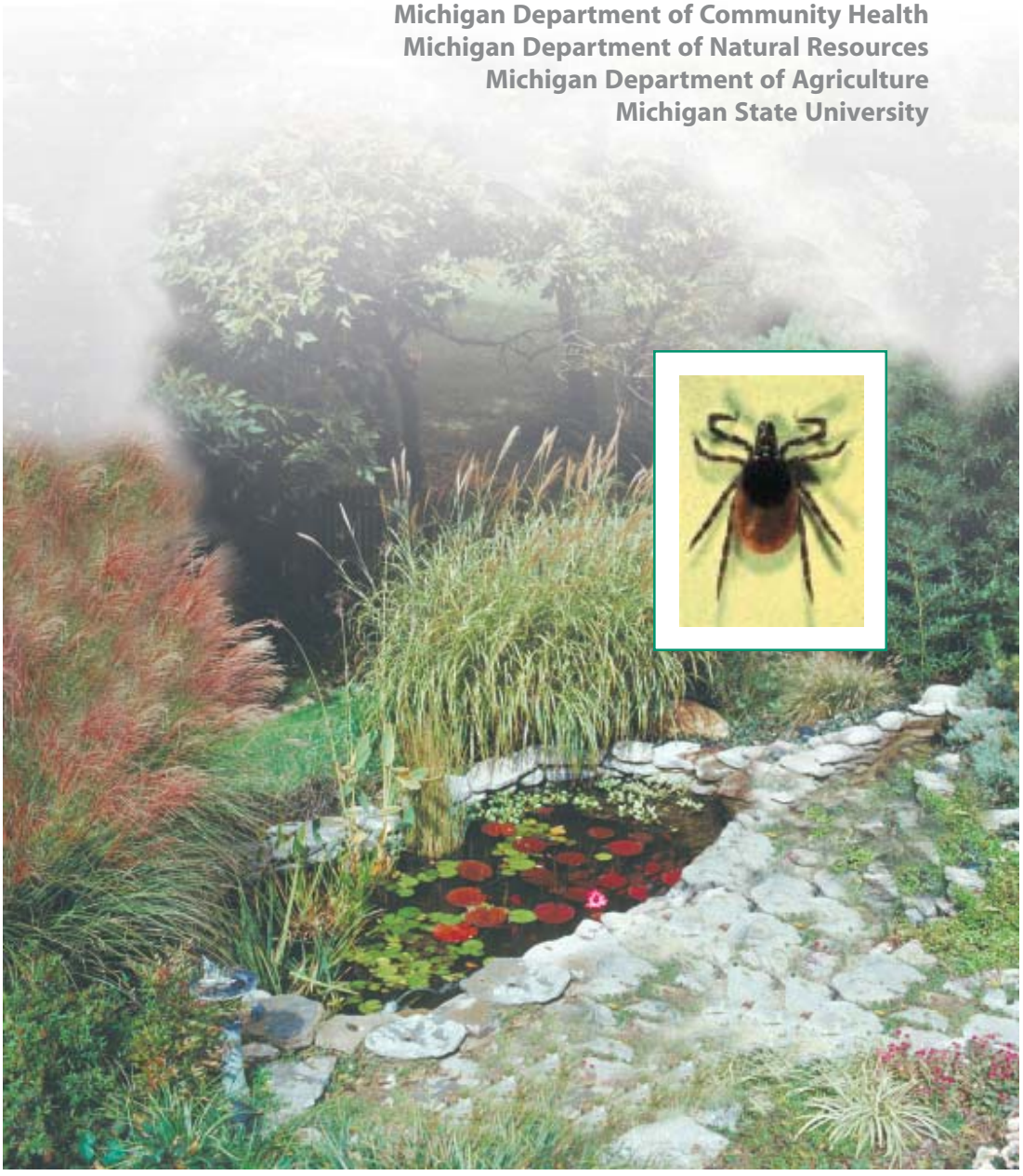
Tick Borne Illnesses in Michigan

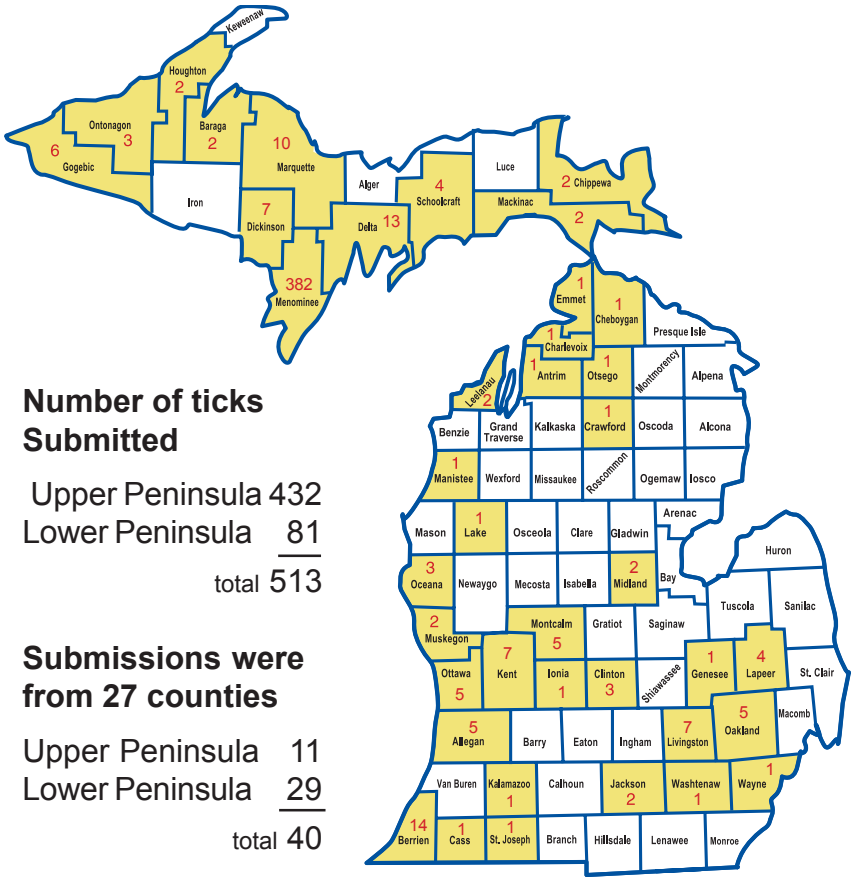
Lyme Disease, Rocky Mountain Spotted Fever, Tularemia, and Ehrlichiosis

Michigan Department of Community Health
Michigan Department of Natural Resources
Michigan Department of Agriculture
Michigan State University



Ixodes scapularis

Black Legged Tick/ formerly Deer tick



Number of ticks Submitted

Upper Peninsula	432
Lower Peninsula	81
total	513

Submissions were from 27 counties

Upper Peninsula	11
Lower Peninsula	29
total	40

Michigan Submissions
1985-2002

General Information

Ticks are significant vectors of pathogens that cause human disease. In Michigan, tick-borne diseases are rare, but they do occur and can be serious if not properly diagnosed and treated. There have been recent fatal cases of Rocky Mountain Spotted Fever and Tularemia in the state.

Ticks are arthropods (relatives of insects) and belong to the order *Acari,* families *Ixodidae* (the hard ticks) and *Argasidae* (the soft ticks). The most commonly encountered ticks in Michigan are hard ticks. Tick habitat is usually associated with their animal hosts, especially in areas where woodlands and grasslands converge and where deer, raccoons, and other wildlife are abundant. They typically can be found in wooded or grassy areas, especially along the edges of trails, roads and yards. *Dermacentor variabilis* ticks (commonly called wood ticks or dog ticks) are most abundant in spring and early summer. *Ixodes scapularis,* (Black Legged ticks) are most abundant from spring through the summer, and into the warm months of the fall. However, ticks have been found on Michigan residents or their pets in all months of the year.

It is important to inform a physician if you are ill and have had recent exposure to ticks. This information can be crucial for accurately diagnosing disease..

Diseases carried by ticks to people and domestic animals are "reportable diseases"; physicians, veterinarians and laboratories that diagnose these conditions are required to report them to local health departments, and animal health regulatory officials, who in turn, report these conditions to the Michigan Department of Community Health.

Treatment

Lyme disease, Tularemia, Rocky Mountain Spotted Fever (RMSF), and Ehrlichiosis are all treatable with antibiotics. Patients and domestic animals treated in the early stages with short courses of antibiotics usually recover rapidly and completely. Several commonly-used antibiotics, such as the tetracyclines, are particularly effective in the treatment of these diseases. Infectious disease physicians are usually the most knowledgeable about treatment options.

The Ticks

The five most common ticks in Michigan are:

- *Dermacentor variabilis* (American Dog tick)
- *Dermacentor albipictus* (Winter tick)
- *Ixodes cookei* (Woodchuck tick)
- *Ixodes scapularis* (Black Legged tick)
- *Amblyomma americanum* (Lone Star tick)

American dog tick

The major vector of RMSF in Michigan is the American Dog tick, *D. variabilis*. It can also transmit the bacteria that causes Tularemia, and can harbor the *Ehrlichiae* bacteria.

Winter tick
Engorged

Dermacentor albipictus is common on deer and elk in northern Michigan. Hunters may find these ticks on animals they have shot, when the animals are being field dressed or when they are at slaughter or being processed for taxidermy purposes. They are uncommon on people and not known to transmit disease.

Black Legged tick

From left to right: *Ixodes scapularis*
Adult female, adult male, nymph, and larva on a centimeter scale.

This tick has been identified as harboring and transmitting bacteria responsible for Lyme disease and Ehrlichiosis.

Lone Star tick

Amblyomma americanum has been identified as harboring the bacteria causing Ehrlichiosis, RMSF, and Tularemia.

Lyme Disease

Lyme disease is an illness caused by the spirochete bacterium *Borrelia burgdorferi.* In the Midwest and Eastern U.S., this disease is transmitted to people and animals by the bite of an infected *Ixodes scapularis* tick. Studies have shown that a tick infected with *Borrelia burgdorferi* must be attached to its host for at least 48 hours for the bacteria to be transmitted. The disease typically progresses through flu-like symptoms, with an unusual bull's eye rash to arthritis of the large joints. Some people, when left untreated, may develop complications involving the heart, nervous system, or arthritis.

Erythema migrans (EM) is a red, circular, rapidly expanding patch that appears at the site of the tick bite within 3 days to 1 month after the bite of an infected tick. It is usually not painful or itchy.

Ixodes scapularis

An electron micrograph of *Borrelia burgdorferi*

Symptoms:

Early Lyme Disease

- Chills and fever
- Headaches
- Muscle and joint pain
- A characteristic skin rash (Erythema migrans)

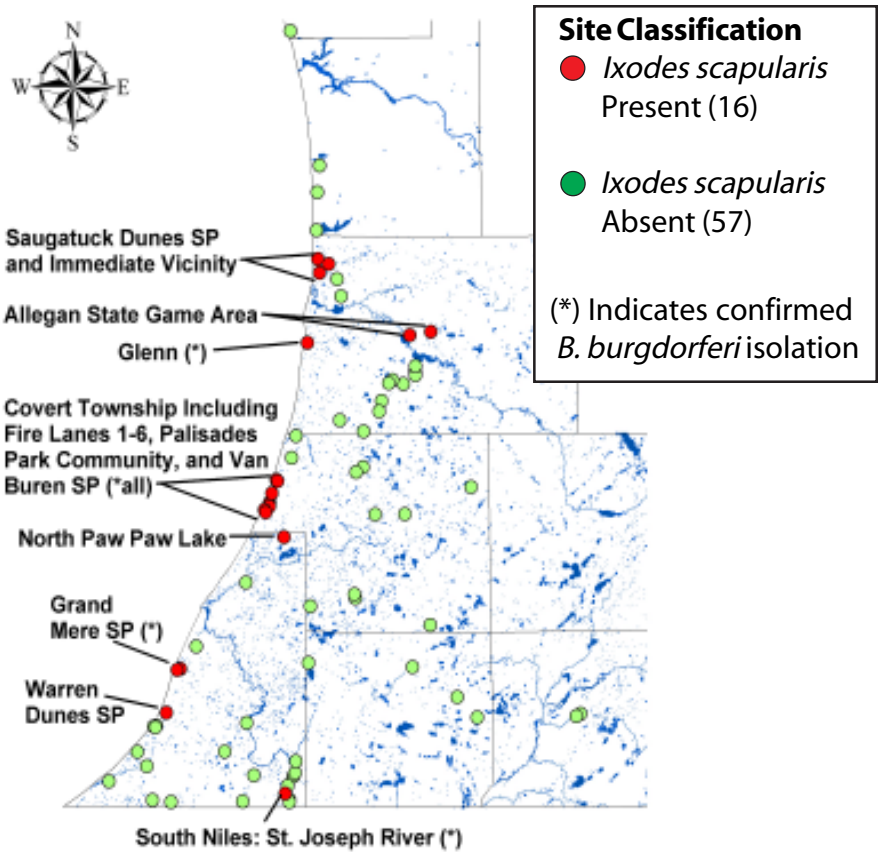
Late Lyme disease

- Arthritis, usually in one or more large joints, especially the knees.
- Nervous system abnormalities can include nerve paralysis (facial muscles), and meningitis.
- Rarely, irregularities of the heart rhythm may occur.

Significant new information regarding the epidemiology of Lyme disease in Michigan has been discovered in 2003. Numerous activities to characterize Lyme disease have been conducted for nearly 20 years in the state. Recently, Michigan State University researchers have been conducting a long-term surveillance project for *Ixodes scapularis* ticks, the vector species for Lyme disease, in southwest Lower Michigan. This project was initiated in 2001 based on ecologic predictors that indicated southwest Michigan has suitable habitat for invasion by this tick species, currently known to be present in Northern Indiana. This study has involved looking for the presence of *Ixodes scapularis* ticks, testing those ticks for infection with *Borrelia burgdorferi*, and looking for evidence of infection in rodents and dogs in the area.

Information being obtained from this ongoing study indicates an emerging presence of *Ixodes scapularis* ticks in Berrien, Van Buren, and Allegan counties in southwest Lower Michigan (see map on back of page). Sampling in Cass and St. Joseph counties has thus far not turned up any *Ixodes scapularis* ticks. According to recent research conducted by Michigan State University's Department of Microbiology & Molecular Genetics, 16 of 73 wooded sites have been found to have *Ixodes scapularis* ticks. More than 200 of these ticks have been tested for *Borrelia burgdorferi* and roughly 40-50 percent of the ticks at six of the 16 sites have tested positive. Several rodents have also been found to be carrying the organism. This data supports the identification of new endemic areas for Lyme disease in Michigan, in addition to previously recognized Menominee County in the Upper Peninsula.

The laboratory at the Michigan Department of Community Health (MDCH), offers the nationally-standardized two-stage serological (blood test) for Lyme disease. Culture of tissues, including EM lesions, is also available.



MSU Insect Microbiology Laboratory

Deer Tick (*Ixodes scapularis*) and Lyme Disease Pathogen (*Borrelia burgdorferi)* Surveillance Map, updated August 11, 2003.

* Field collections of *I. scapularis* by direct sampling (flagging), and rodent host trapping
* Sampling timeframe: May 2002-August 2003
* *Borrelia* isolates by culture and PCR
* Other surveillance methods include:
  - -Veterinary Serology Testing
  - -Hunter Killed Deer Screening

Research activities conducted under the guidance of Dr. Edward Walker by Erik Foster. Unpublished Data, for more information contact Dr. Edward Walker (walker@msu.edu) or Erik Foster (fostere2@msu.edu).

Wildlife and Companion Animals

The tick*, Ixodes scapularis* has a multi-staged life cycle, therefore numerous wildlife species have the opportunity to be exposed to this vector and the Lyme disease bacteria. Small mammals are a preferred host for the tick, but birds, reptiles, and large mammals can also harbor the various stages of the tick. Clinical Lyme disease has not been diagnosed in any wildlife species in Michigan. Deer and white-footed mice can serve as hosts for the tick and the Lyme disease organism.

Clinical Lyme disease in domestic animals may involve many organ systems. Fever, loss of appetite, depression, lethargy, swelling and pain in one or more joints, kidney disease, heart disease, and nervous system disorders have all been reported. An accurate diagnosis can only be made by a veterinarian. A Lyme disease vaccine is available. Consult your veterinarian about the appropriateness of vaccinating your pet and also to discuss recommendations for avoiding ticks.

Rocky Mountain Spotted Fever (RMSF)

RMSF is a tick borne febrile illness most commonly characterized by acute onset and usually accompanied by malaise, myalgia, headache, nausea, and petechial rash. This rash is present in 2/3 of cases and appears as small red spots or blotches that begin on the wrist, ankles, palms, and soles. It spreads up the arms and legs toward the trunk. It is the most prevalent rickettsial disease in the U.S. In Michigan, most RMSF cases have been reported from the lower half of the Lower Peninsula. Additionally, cases are regularly reported from northwestern Ohio and northern Indiana. RMSF is caused by tiny, roundish bacteria called *Rickettsia rickettsii*, which are transmitted through the bite of a tick. Several tick vectors may be involved in RMSF transmission, but the primary one in Michigan is the American Dog tick, *Dermacentor variabilis*. This tick is the most common tick in the state and is found throughout Michigan.

Hand with petechial rash

Symptoms:

Symptoms begin 3-12 days after tick exposure. Once symptoms develop, death can occur within two weeks without proper treatment. At the time of initial presentation, the classic triad of RMSF, fever, rash and history of tick bite, is often present.

Other Characteristics:

- Malaise
- Severe headache
- Chills and Myalgia

Wildlife and Companion Animals

Various wildlife species serve as hosts of the RMSF rickettsial organism and the ticks themselves: deer, fox, wolf, badger, opossum, rabbit, raccoon, skunk, squirrel, deer mice, and chipmunks. RMSF disease has not been diagnosed in any of these wildlife species.

Dogs are very susceptible to RMSF. Other small domestic mammals that are allowed outdoors or have contact with infected ticks may also contract this disease. Signs of RMSF include combinations of fever, lack of appetite, arthritis, shortness of breath, coughing, abdominal pain, nervous system disorders and swelling of the face or extremities. Small hemorrhages on the mucous membranes occur in severe cases. Transmission from dogs to humans does not occur, but people should exercise caution when removing ticks from pets, as the fluids from the tick can carry the RMSF organism.

Tularemia

Tularemia is a rare infection caused by the bacteria *Francisella tularensis*. *F. tularensis* is a bacteria widely distributed in nature. This bacteria resides in many animal species and is transmitted by direct contact or a bite from a tick or deer fly. *Amblyomma americanum* and *Dermacentor variabilis* ticks may harbor and transmit this bacteria. Humans can also contract the illness through direct contact with an infected animal carcass, especially rabbits. Epidemics may also occur through ingestion of water contaminated with the bacteria. Rare cases have been reported in Michigan.

Clinical Manifestations:

Deer Fly

Six classic forms of the disease have been described: ulceroglandular, glandular, oculoglandular, typhoidal, intestinal, and pneumonic. The most common manifestation of *F. tularensis* in the U.S. is the ulceroglandular form as a result of tick bites or contact with an infected animal. The average incubation period is approximately 3 to 5 days, but can vary from 1 to 21 days.

Symptoms:

- Ulcerative lesion at the site of inoculation
- Regional lymph node swelling
- Pneumonia
- Fever, chills
- Headache
- Muscle pain and joint stiffness

Tularemia is also known as Rabbit Fever

Wildlife and Companion Animals
In Michigan, wildlife species that have been diagnosed with Tularemia are muskrats, beavers, cotton-tail rabbits, snowshoe hares, and a Great Horned Owl. The last 2 occurrences in Michigan were in 1981 in beavers and in 1994 in beavers and muskrats.

Infection with *F. tularensis* has been reported in dogs, cats, pigs, and horses, as well as over 250 other wild and domestic mammals, birds, reptiles and fish. Cattle appear to be resistant. Incubation in animals varies from 1 to 10 days. The disease is characterized by sudden onset of high fever, lethargy, lack of appetite, stiffness, and increased pulse and respiratory rates. Animals that recover from the disease are generally immune to repeat infection.

Human Ehrlichiosis

There are two distinct forms of illness recognized: human monocytic ehrlichiosis (HME), caused by *Ehrlichia chaffeensis*, and human granulocytic ehrlichiosis (HGE), caused by an agent similar or identical to the veterinary pathogens *E. equi* and *E. phagocytophila. Ehrlichiae* are bacteria that primarily invade leukocytes (white blood cells).
The bacteria is transmitted to humans through the bite of infected ticks, which acquire the agents after feeding on infected animal reservoirs. *Ixodes scapularis* and *Amblyomma americanum* ticks are capable of transmitting this disease in Michigan.

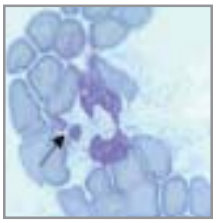
Symptoms:

- Fever
- Headache
- Malaise and muscle aches.
- Other signs may include nausea, vomiting, diarrhea, cough, joint pain, confusion, and occasionally, a rash.

HGE has not yet been found in Michigan but it has been diagnosed in patients in Wisconsin and Minnesota. Also, HME is occasionally reported in Indiana. Because the vector *Ixodes scapularis* is found in Michigan and the state's close proximity to the state of Wisconsin, the emergence of this disease is being closely monitored in Michigan.

Wildlife and Companion Animals

The preferred reservoir hosts for HME are white-tailed deer and small rodents, and for HGE, white-tailed deer, elk, meadow voles, white-footed mice, coyotes, and wood rats. None of these wildlife species have been diagnosed with the disease but they can act as hosts for the *Ehrlichia* organism.

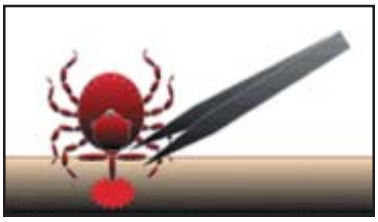


Ehrlichiae dividing in white blood cell

The disease in dogs, caused by *Ehrlichia canis*, and other *Ehrlichia* species, mimics RMSF. *Ehrlichia risticii* causes a similar disease known as Potomac Horse Fever (PHF) in horses. Diarrhea and laminitis are also frequently reported with PHF. These diseases cannot spread directly from dog to dog or horse to horse but must pass through the arthropod (tick) vector. No PHF vector has yet been definitely identified.

Tick Removal

Ticks can attach to any part of the human body but prefer body creases and areas with hair such as the groin, armpits, sock line and scalp.



To remove attached ticks, use the following procedure:

1. Using fine-tipped tweezers, grasp the tick by the head as close to the skin as possible then gently, but firmly, pull it straight out. Do not twist or jerk the tick, apply petroleum jelly, a hot match, or other irritants. This can lead to infection because the tick's mouth parts may remain embedded, or you may be burned. Use your fingernails and tissue paper if tweezers are not available.
2. Immediately wash the bite area and your hands with soap and water then apply an antiseptic to the bite wound.
3. If in doubt of tick identification, place the tick in a small vial containing a damp piece of tissue and submit it to your local health department for examination.

Prevention

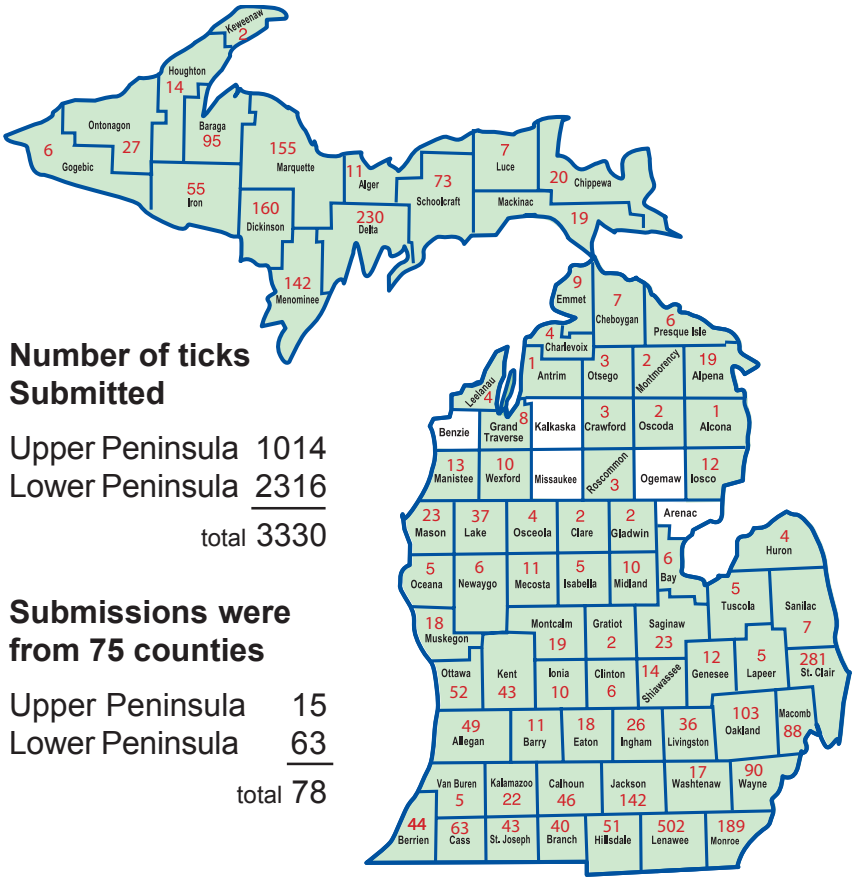
- Wear enclosed shoes and light colored clothing which makes ticks easier to locate for removal.
- Tuck pants into socks and wear long-sleeved shirts.
- Apply insect/tick repellent containing DEET, and treat clothes with permethrin. Follow the product label directions for proper use.
- Walk in the center of trails to avoid contact with overgrown grass and brush at trail edges.
- Upon returning from potentially tick-infested areas, search your entire body for ticks.

Tick Identification and Testing

Expert tick identification is available at a number of state agencies. For tick identification and possible testing for certain tick-related diseases, contact your local health department environmental health division office for a tick submission kit. A tick submission kit will have all the necessary instructions and a container for mailing to the appropriate state agency.

Dermacentor variabilis

American Dog tick



Number of ticks Submitted

Upper Peninsula	1014
Lower Peninsula	2316
total	3330

Submissions were from 75 counties

Upper Peninsula	15
Lower Peninsula	63
total	78

Michigan Submissions 1988-2002

Number of copies printed: 70,000. Total cost: $11,281.50; Cost per copy: $ 0.161

Additional Information

For information regarding specific questions about the effects of these tick borne illnesses on human health, wildlife, or domestic animals, consult one of the agencies listed below:

Michigan Department of Community Health
Communicable Disease and Immunization Division
517-335-8165
3423 N. Martin L. King Jr. Blvd.
P.O. Box 30195
Lansing, MI 48909
www.michigan.gov/mdch

Michigan Department of Natural Resources
Rose Lake Wildlife Disease Laboratory
517-373-9358
8562 E. Stoll Road
East Lansing, MI 48823
www.michigan.gov/dnr

Michigan Department of Agriculture
Animal Industry Division (517)373-1077 or
Pesticide & Plant Pest Management Division
517-241-1169
P.O. Box 30017
Lansing, MI 48909
www.michigan.gov/mda

Michigan State University
Department of Entomology
517-355-4663
243 Natural Science Building
East Lansing, MI 48824
www.msue.msu.edu

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www.medscape.com

www.adam.com

www.lymediseaseinformation.com

Roger O. Drummon

Centers for Disease Control and Prevention

Iowa State University
Department of Entomology

Wadsworth Center
New York State Department of Health

United States Department of Agriculture

University of Florida

University of California
Department of Entomology